
GM
GMC

A Review of Electric Vehicle Technology and Ways to Facilitate Increased Vehicle Adoption

Presented to
Utah Legislature Interim Committee on Transportation
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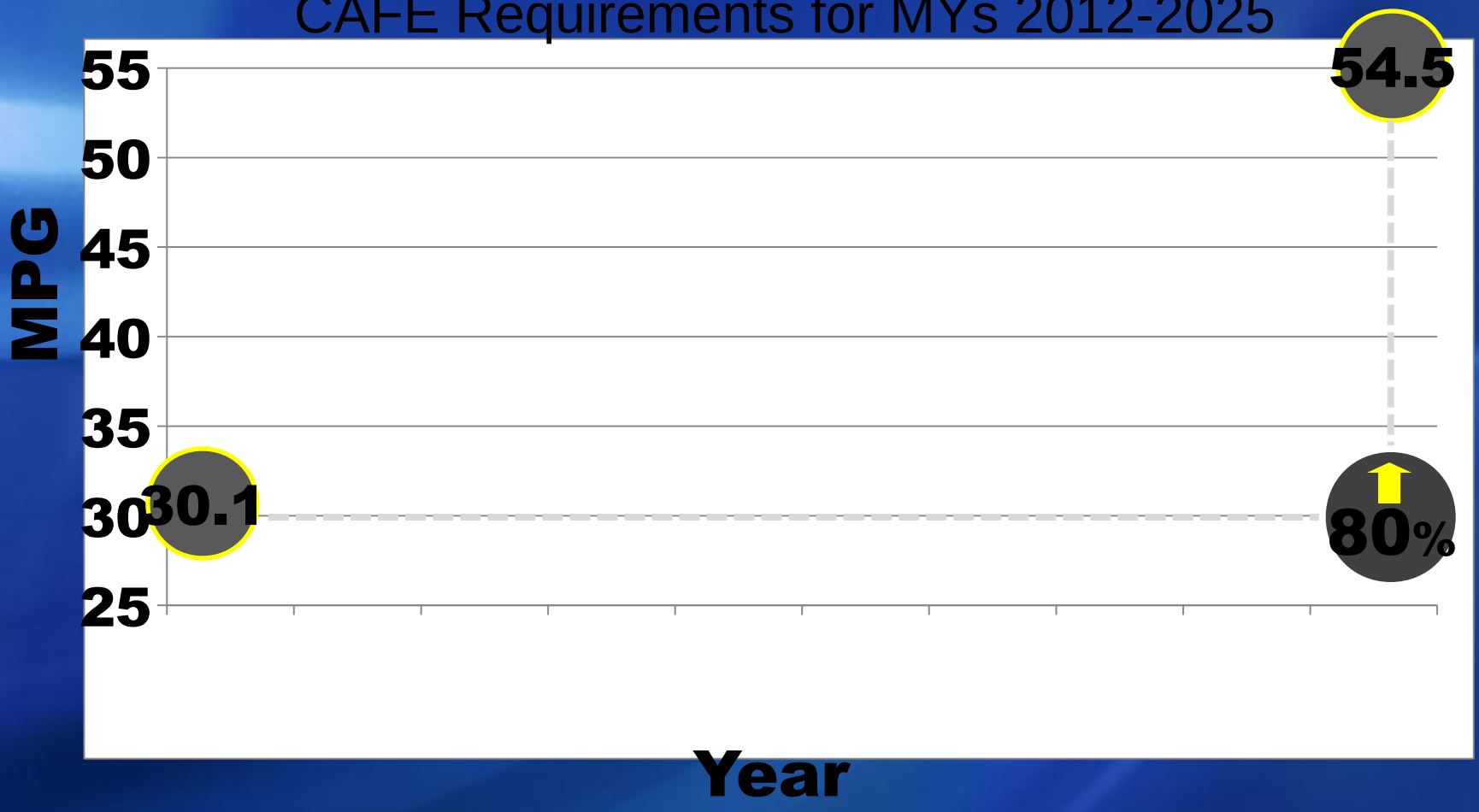
Western Region

Steep Climb for Automakers on Corporate Average Fuel Economy (CAFE)



Source: EPA

GM's Propulsion Strategy

FUEL EFFICIENCY

Engine and Transmission Improvements

BIOFUELS

Ethanol-blend and Biodiesel

CNG & LPG

Compressed Natural Gas & Liquefied Petroleum Gas

HYBRID

eAssist

Full- Hybrid Electric

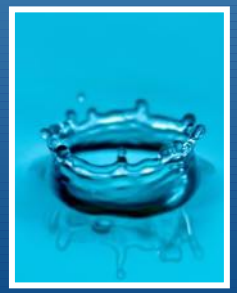
ELECTRIC

Extended-Range Electric

Battery Electric

FUEL CELL

Hydrogen Fuel Cell



Transitioning from Internal Combustion to Electrified Propulsion

Petroleum and Biofuels
(Conventional and Alternative Sources)

Electricity and Hydrogen
(Zero Emissions Energy Sources)

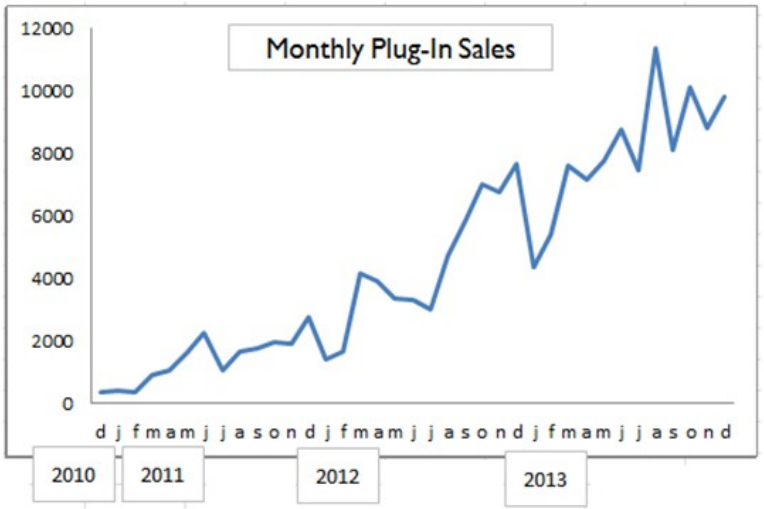
eAssist	Full Hybrid (2-4 mode)	Plug-in Hybrid	Extended Range Electric	Battery Electric	Fuel Cell Electric

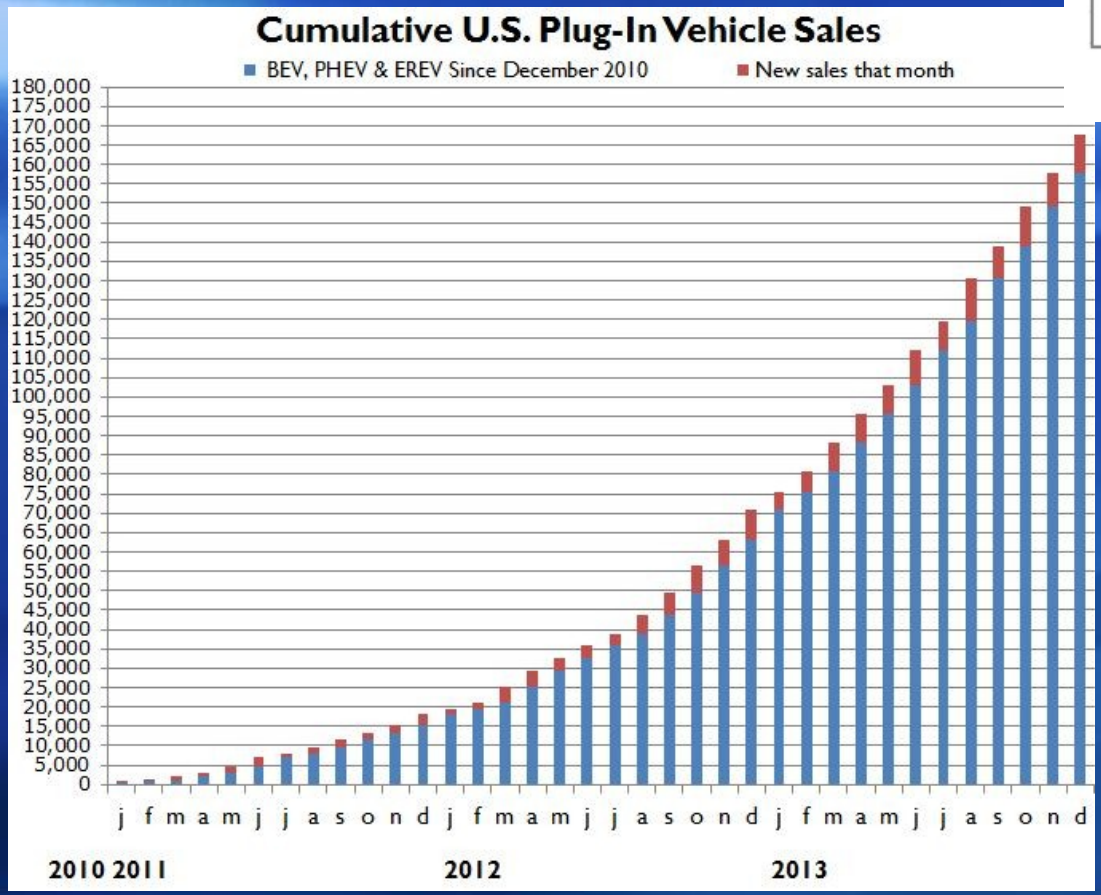
Increasingly Electrified Powertrains

- **Solutions needed for a full range of vehicles that provide customer choice.**
- **Battery and Fuel Cell vehicles provide petroleum/emissions-free options.**
- **Only Fuel Cell vehicles provide**

Approximate Recharge Times (miles/min)				
Gasoline	Electric			Hydrogen
	15 kW	50 kW	1MW	
150	*1*	*4*	*70*	*100*

EDTA®
Electric Drive Transportation Association

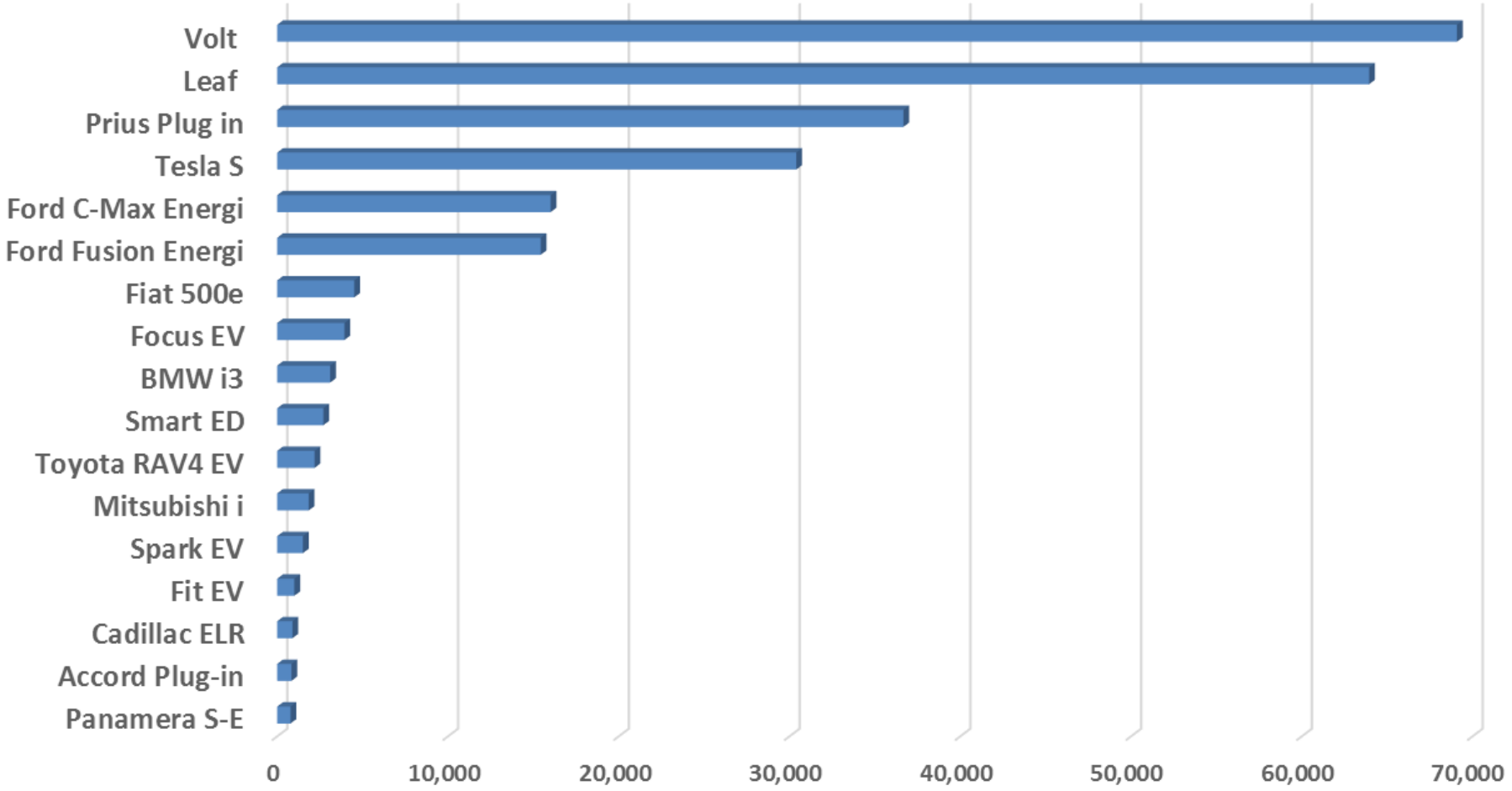




Total PEV Sales: Launch to Date

(Source: www.insideevs.com)

As of: End of Sept 2014



Total Industry Sales of PEVs currently 255,000

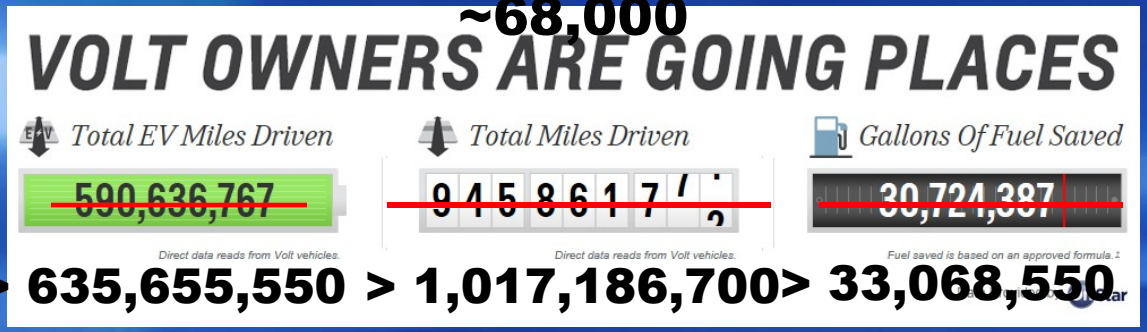

Back
Home
Fav
75°F
11:16 AM
Home Page
Now Playing
ECO
Phone
Climate Control
AM
FM
XM
CD
Last
1 of 2
CLIMATE
AUTO
TUNE MENU
TONE
BACK
CONFIG
SOURCE
SEEK
TP
FAV
SEEK
VOL
AS 1-2
INFO
DRIVE MODE


VOLT

Chevrolet Volt Impact to Date*

Volts sold through August 2014

~68,000



> 635,655,550 > 1,017,186,700> 33,068,550

Chevrolet Volt Earns IIHS Top Safety Pick + Award

Only small car of 12 in recent testing to earn distinction

2014-07-30

Source: www.chevrolet.com/volt-electric-car.html running ticker on Sept 03, 2014

* Only Includes Opted-in vehicles

Electric Miles Comparison: DOE *EV Project* Data

	Number of Vehicles	Vehicle Months	VMT	e-VMT	Average Monthly VMT	Average Monthly e-VMT
Chevrolet Volt	1,867	20,545	20,950,967	15,599,508	1,019.8	**759.3**
Nissan Leaf	4,039	35,294	28,520,792	28,520,792	808.1	**808.1**

The electric miles traveled (e-VMT) of the Chevrolet Volt is comparable to that of pure battery electric vehicles such as the Nissan Leaf.

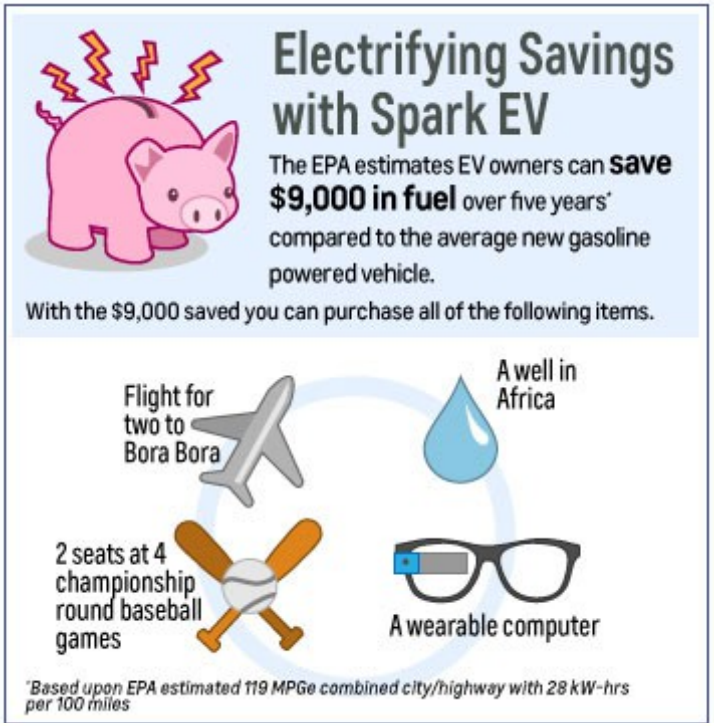
Source: *How many electric miles do Nissan Leafs and Chevrolet Volts in The EV Project travel?* published by Idaho National Laboratory, May 2014. See http://avt.inel.gov/pdf/EVProj/eVMTMay2014.pdf.

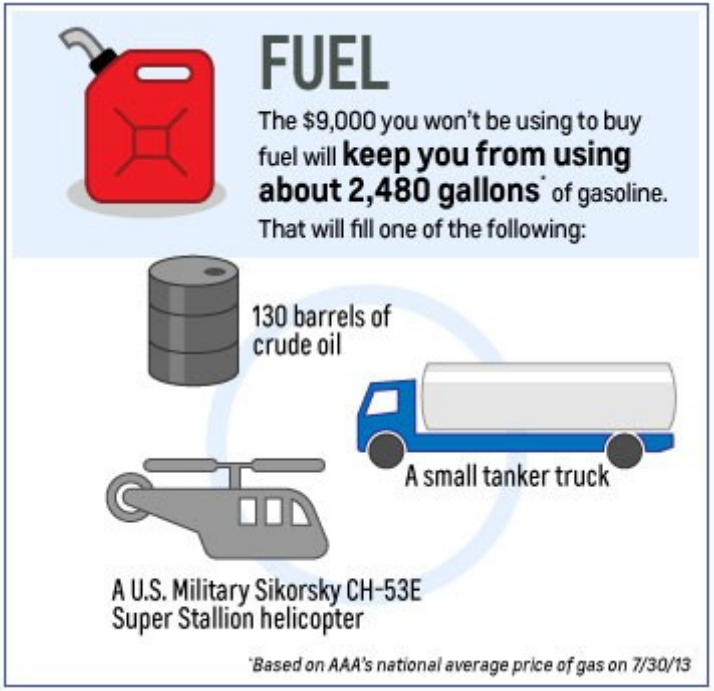

SPARK
EV


DC FAST CHARGE
WELCOME
GM
DC
FAST

Chevrolet Spark EV

- Sales began Summer 2013
- EV range = 82 Miles
- EPA-estimated 119 MPGe (combined City/Highway)—the most efficient U.S. retail electric vehicle on the market
- Battery (2015) is 18.4 kWh Lithium Ion
- Drive unit and motor manufactured in GM White March (MD), which will get you 0-60 mph in 7.2 seconds
- Includes connect car features like MyLink and the BringGo app (full-function navigation)
- Charging will take less than 7 hours with 240V.
- SAE Combo DC Fast Charging option: Charging 80% of the battery in 20 minutes.





ELR

Cadillac ELR

Extended range luxury coupe (2+2)

- **Performance:**
  - 37 miles electric range (EPA)
  - Full driving range 340 miles
  - 295 ft-lbs of torque

Notable Features

- *Regen on Demand* – regenerative braking via steering-wheel paddles
- Programmable charging schedules and energy efficiency reports
- 4 Drive Modes – Tour, Sport, Mountain, Hold
- LED headlamps, daytime running lamps & taillamps.
- Advanced chassis & suspension, including HiPer Strut front suspension
- Cadillac's CUE system with Navigation and 8" multi-touch screen

What's next?

2nd generation *Volt*..... and more.

Keys to Increasing Adoption

- Incentives & Enablers
- Charging Infrastructure
  - Home
  - Workplace
  - Public
- Stakeholder Collaboration
- Regulatory symmetry

Incentives & Enablers

PEV Deployment: A Joint Effort

Required Stakeholders

- Dedicated project leader
- State, city, county
- Clean Cities Orgs/AQMD
- DOT
- Utilities (municipal and regional)
- Regulators/public utility commissions
- Permitting and code officials
- Local employers
- Local universities

Desired Enablers

Sample of other Western State efforts

Arizona:

- HOV lane access for plug-in vehicles
- EVSE tax credit
- Glendale Water & Power: Discounted electric rates for vehicle charging

California:

- Clean Vehicle Rebate Program (CVRP), $1,500 or $2,500 based upon technology
- HOV lane access
  - ZEV and ILEV vehicles (“White Sticker” program)
  - TZEV vehicles (“Green Sticker” program)
- Various local AQMD and municipal programs

Colorado:

- Tax credits for qualifying vehicles, up to $6,000 based upon battery size

Sample of other Western State efforts

Hawaii:

- **HOV lane access for qualifying vehicles**
- **Exempts qualifying vehicles from certain parking charges levied by state and local agencies**

Idaho:

- **Emissions testing waiver for qualifying vehicles**

Nevada:

- **Emissions testing waiver for qualifying vehicles**
- **NV Energy: Discounted rates for electric vehicle charging**

Sample of other Western State efforts

Oregon:

- **$1,500 tax credit (expired)**
- **EVSE tax credit ≤ $750**
- **MDU legislation to ensure home charging infrastructure**
- **EVSE permitted on State property, public use permitted**
- **State fund for Agency purchase of alternative fuel vehicles**

Texas:

- **$2,500 rebate for qualifying vehicles in non-attainment areas from TCEQ administered air quality fund (TERP)**

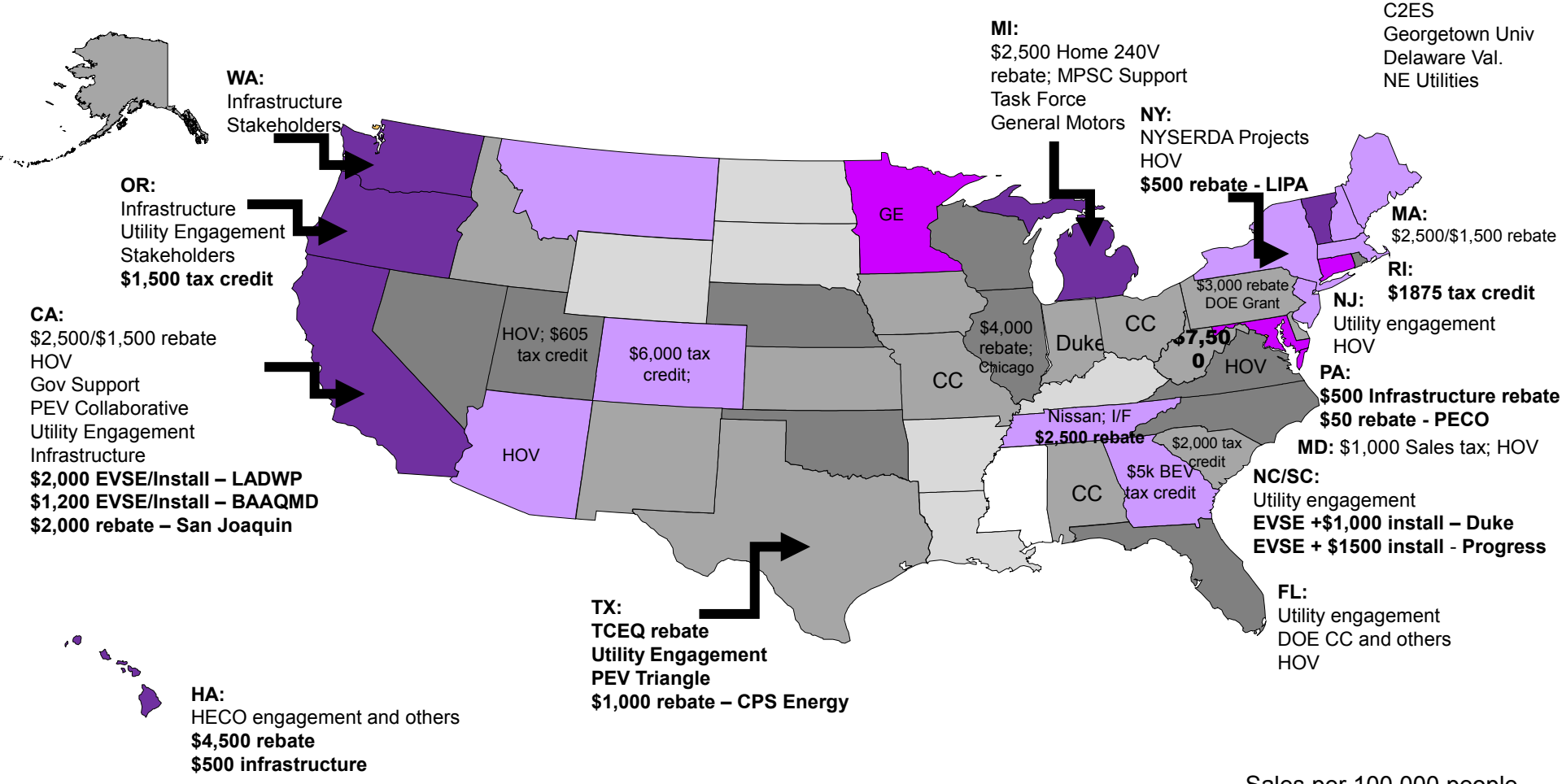
Washington:

- **Tax credit for qualifying vehicles**

… and that's just the Western States

PHEVs)

Sales per 100,000 people – through August 2013



Together with complementary policies, there is good correlation between states with PEV sales and those states with strong stakeholder engagement efforts.

Charging Infrastructure

Infrastructure

Charging is more convenient than ever before

- 120V outlets (overnight or during the work day)
- 240V hardwired (several hours)
- DC fast-charging (20-30 minutes)

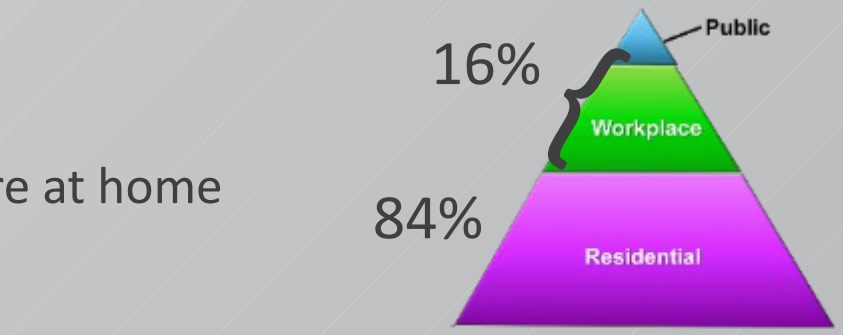
Clear charging patterns are emerging

- Home charging – 60-80% of all charging is at home
- Workplace charging – proving to be the most helpful promoter of PEVs through awareness and incentive
- Public charging – least used, but most visible

Home vs. Work vs. Public Charging

- Overall EV drivers:

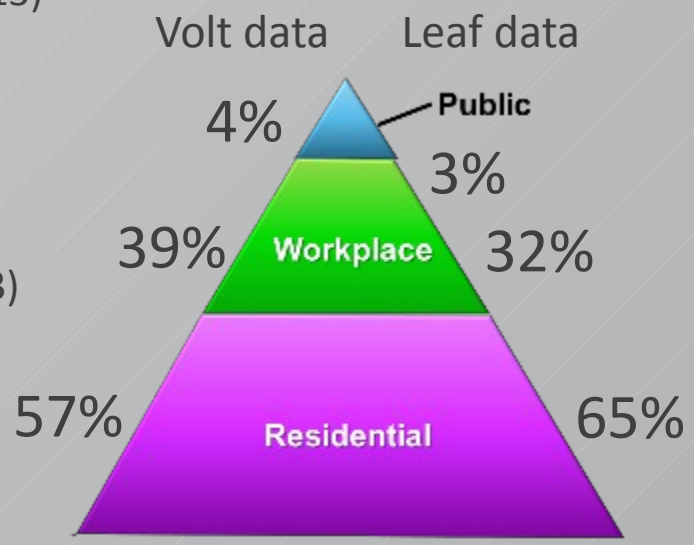
  Study Period 1/1/2012 – 12/31/2013
  - 84% of all charging events are at home
  - 16% not at home



- When workplace charging is available to an EV driver:

  (96 Volts with access to workplace charging Jan '13 – Dec '13)
  - 57% of charging events are at home
  - 39% at work
  - 4% at other locations (e.g. public)

(707 Leafs with access to workplace charging Jan '12 – Dec '13)
  - 65% of charging events are at home
  - 32% at work
  - 3% at other locations (e.g. public)



Residential and workplace charging provide the vast majority of all charging.

Source: John Smart, INL, EV Project; Link to all reports = http://avt.inel.gov/librarybydate.shtml

432 GM WORKPLACE CHARGING STATIONS

Including 21 Assembly Plants

Michigan 278

New York 51

Ohio 30

California 32

Indiana 8

Connecticut 2

Illinois 2

Maryland 8

Arizona 2

Kansas 2

Kentucky 12

Texas 3

Georgia 2

Also: Chevrolet and Cadillac dealers have installed approximately 5,900 charge stations at their locations for owner use – 17 of these dealerships use solar charging canopies.

Stakeholder Collaboration

Stakeholder Collaboration: We're All Part of the Solution

- OEMs
- Government
  - Local
  - State
    - Legislature
    - Agencies
  - Federal
- Utilities & ISOs
- EV Stakeholders/NGOs
- Developers

DOE's Workplace Charging Challenge Partners

➔ Goal is tenfold increase in 5 years

Questions?

Thank You